APPENDIX

Highway Adequacy Index
Scoring Methodology

Basic Elements:
The Highway Adequacy Index (HAI) is a 100 point index comprised of three major sub-indices:

Condition – 50 Points
Service – 25 Points
Safety – 25 Points

Each section of roadway is rated in all three of the sub-indices as outlined below with an accumulative HAI assigned. The HAI alone does not truly tell the user of the data whether they are evaluating a "good" section or a "bad" section. In order to better describe the HAI the following rating categories have been identified:

Good – Over 80
Fair – 70 to 80
Poor – 60 to 70
Critical – Under 60

Analysis Sections of Network:

Every analysis of a highway network requires that the network be sectioned for rating and analysis. The sectioning of the network allows for usable ratings for comparative analysis. The HAI is based on Highways Elements. These are single sections of roadway with a node at each end. The average segment length is 0.11 mi, with a range of lengths from 0.01 to 0.68 mi.

Condition Index (50):

The condition index is comprised of 5 data items, these items are listed below with their corresponding maximum point values:

International Roughness Index – 20 Points
Posted Road – 10
Rutting – 10
Structural Cracking – 5
Functional Cracking – 5

International Roughness Index:

Data Source: TIDE – Road Segment
Qualification: Max IRI on Element

IRI is measured as inches of vertical displacement per mile of travel. "Acceptable to the user" has been defined by FHWA to mean an IRI of less than 95 as good, less than 170, acceptable, and greater than 170, poor. While this is the range adopted by FHWA in 2002, a tiered system that held Interstate to a higher standard was previously used, and defined 120 as the upper limit for acceptable on the Interstate system. The following is the scoring range applied to each element:

Interstate and Other Freeways and Expressways:

Less than 120 – 20 points
120 to 130 – 18 points
130 to 140 – 16 points
140 to 150 – 14 points
150 to 160 – 12 points
160 to 170 – 10 points
170 to 180 – 8 points
180 to 190 – 6 points
190 to 200 – 4 points
200 to 210 – 2 points
Greater than 210 – 0 points

Other Principal Arterials, Minor Arterials, and Major Collectors:

Less than 170 – 20 points
170 to 185 – 18 points
185 to 200 – 16 points
200 to 215 – 14 points
215 to 230 – 12 points
230 to 245 – 10 points
245 to 260 – 8 points
260 to 275 – 6 points
275 to 290 – 4 points
290 to 305 – 2 points
Greater than 305 – 0 points

Posted Road:

Data Source: G:\Shapes\Road Shapes\Posted_2005.dbf
There are preliminary plans to add posted road data to highways in the future. Data source would then be TIDE.

Qualification: Query by RLM for specific elements using conditional joins

Posted – 0 points
Not Posted – 10 points

Rutting:

Data Source: TIDE – Road Segment
Qualification: Max of Right Rut on Element

Interstate and Other Freeways and Expressways:

Less than 0.10 – 10 points
0.10 to 0.15 – 9 points
0.15 to 0.20 – 8 points
0.20 to 0.25 – 7 points
0.25 to 0.30 – 6 points
0.30 to 0.35 – 5 points
0.35 to 0.40 – 4 points
0.40 to 0.45 – 3 points
0.45 to 0.50 – 2 points
0.50 to 0.55 – 1 point
Greater than 0.55 – 0 points

Other Principal Arterials, Minor Arterials, and Major Collectors

Less than 0.10 – 10 points
0.10 to 0.20 – 9 points
0.20 to 0.30 – 8 points
0.30 to 0.40 – 7 points
0.40 to 0.50 – 6 points
0.50 to 0.60 – 5 points
0.60 to 0.70 – 4 points
0.70 to 0.80 – 3 points
0.80 to 0.90 – 2 points
0.90 to 1.0 – 1 point
Greater than 1.0 – 0 points

Functional and Structural Cracking:

Data Source: dTIMS CT
Calculation: (Cracking Index *5)/100

Service Index (25):

The Service Index is comprised of two data items. These items are listed below with their maximum point values:

Delay Ratio – 15
Speed Limit – 10

Delay Ratio:

Data Source: TIDE, Road Segment
Qualification: Seglen, Avg Speed, Posted Speed
Calculations: Delay Ratio = Actual travel time/Free flow travel time
Actual travel time = Seglen/avg speed
Free flow travel time = Seglen/(Posted Speed +5)

Once the Delay Ratio is calculated the following scale is used for scoring:

1.00 to 1.08 – 15
1.08 to 1.16 – 12
1.16 to 1.24 – 9
1.24 to 1.32 – 6
1.32 to 1.40 – 3
Greater than 1.40 – 0

Speed Limit:

Data Source: TIDE, Road Segment
Qualification: Speed Limit

The points are allocated for speed limit as follows:

Interstate and Freeways

Speed Limit (MPH)	State Urban	State Rural
<= 30	0	0
35	2	0
40	4	0
45	6	2
50	8	4
55	10	6
60	10	8
>=65	10	10

Arterials

Speed Limit (MPH)	State Urban	State Rural
<=30	2	0
35	4	2
40	6	4
45	8	6
50	10	8
>=55	10	10

Major Collectors

Speed Limit (MPH)	State Urban	State Rural
25	4	0
30	6	0
35	8	2
40	10	4
45	10	6
50	10	8
>=55	10	10

**Note: Posted speeds on non-routed highways are system defaults.

Safety Index (25):

The safety index includes two major components, history and standards. The following is the breakdown of the point allocation:

Standards – 10
- Lane Width – 2
- Shoulder Width – 4
- Shoulder Type – 4

Crash history – 15

Crashes per HMVM – 4
Crashes/Mile – 4
Injury Crashes – 4
Ran of Road Rate – 3

Standards:

Data Source: TIDE, Road Segment
Qualification: Geometrics either meet or fail standards

The following table of standards is utilized for the standards test:

Interstate and Freeways

AADT	Lane	Left Shoulder	Right Shoulder	Shoulder Type
<1000	12	4	10	Paved
1000-2000	12	4	10	Paved
2000-4000	12	4	10	Paved
4000-6000	12	4	10	Paved
6000-8000	12	4	10	Paved
>8000	12	4	10	Paved

Principal Arterials

AADT	Lane	Left Shoulder	Right Shoulder	Shoulder Type
<1000	11	6	6	Paved
1000-2000	12	6	6	Paved
2000-4000	12	8	8	Paved
4000-6000	12	8	8	Paved
6000-8000	12	8	8	Paved
>8000	12	8	8	Paved

Minor Arterials

AADT	Lane	Left Shoulder	Right Shoulder	Shoulder Type
<1000	11	3	3	Gravel
1000-2000	11	3	3	Paved
2000-4000	11	3	3	Paved
4000-6000	11	4	4	Paved
6000-8000	12	6	6	Paved
>8000	12	8	8	Paved

Major Collectors

AADT	Lane	Left Shoulder	Right Shoulder	Shoulder Type
<1000	10	2	2	Gravel
1000-2000	11	3	3	Paved
2000-4000	11	3	3	Paved
4000-6000	11	4	4	Paved
6000-8000	12	6	6	Paved
>8000	12	6	6	Paved

Crash History:

Data Source: TIDE, Crash, Road Segment
Qualification: Crash data is qualified for Type, and Injury level

Comparable crash rates are first calculated for the applicable systems based on Urban/Rural and FFC for each of the four crash types. Corresponding rates are then calculated for each element. For these calculations crashes are assigned to an element if they happen at **either end node or on the element**. Point allocation for the crash history is listed below:

< Statewide Average – 4
<1.5 Statewide Average – 3
< 2 Statewide Average – 2
<2.5 Statewide Average - 1
>2.5 – 0

The following are the crash rates used to assign points for individual elements:

Crash History Threshold Values

State Urban/Rural	Federal Functional Class	Crashes/ Mile	Crashes/ HMVM	% Injury	% Run Off Road
Rural	Principal Arterial - Interstate	7.39	65.48	30%	34%
Urban	Principal Arterial - Interstate	16.25	109.08	30%	20%
Rural	Principal Arterial – Freeway/Expressway	19.19	121.71	28%	22%
Urban	Principal Arterial – Freeway/Expressway	21.77	201.10	34%	9%
Rural	Other Principal Arterial	11.20	148.51	34%	21%
Urban	Other Principal Arterial	83.66	539.64	32%	5%
Rural	Minor Arterial	9.27	168.11	32%	24%
Urban	Minor Arterial	48.89	404.46	31%	6%
Rural	Major/Urban Collector	4.24	190.18	32%	39%
Urban	Major/Urban Collector	16.17	320.81	29%	14%